CLAIMS

1. A method for improved control of etch or deposition in a semiconductor manufacturing process to produce a structure having a small feature size, the method comprising:

providing an illumination source at one or more selected wavelengths;

generating from said illumination source an optical probe measurement beam;

illuminating an article undergoing processing with said beam, the article having within the area of illumination an ordered feature arrangement having a feature size of the same order as the structure to be produced and being arranged in a regular pattern having a given feature spacing or spacings;

said selected wavelength or each of said selected wavelengths being within 30% of a whole number of wavelengths of a size equal to the projection on a plane normal to the illuminating radiation of said feature spacing or a respective one of said feature spacings;

detecting an oscillation of a polarisation component in the light beam reflected from the article being processed which is derived substantially from anomalous reflection or Rayleigh Resonance at the feature arrangement resulting from the illumination; and

using the oscillation to detect or predict the desired endpoint or monitor the progress in real time of the etch or deposition.

2. The method of claim 1, in which the ordered feature arrangement is a test structure applied to the article for the purpose of monitoring the process.

3. The method of claim 1, in which the ordered feature arrangement comprises structural features of the desired article itself.

4. The method of claim 1, in which the article has an overlying mask which is substantially opaque to the wavelength of the illumination source.

5. The method of claim 1, in which the ordered feature arrangement has a ratio of feature open to etch to features masked from the etch of between 5% and 95%.

6. The method of claim 5 in which the ordered feature arrangement has a simple repeat of the etch structure.

7. The method of claim 5 in which the ordered feature arrangement has no simple repeat of the etch structure.

8. The method of claim 1, in which the probe beam has a linear transverse dimension of 5μm or more.

9. The method of claim 1, further including comparing the oscillation information with a model of predicted behaviour.

10. The method of claim 9, in which said model is created by analysing the process critical features, which analysis takes as its input the design of the features and their arrangement with other features in the three dimensions of the overall component together with the optical properties of the materials and the illumination wavelength or wavelengths of the illumination source.

11. The method of claim 10, in which said analysis includes analysis of the behaviour of the illuminating radiation together with its polarisation modes and the interference resulting from the etched (or deposited) film as its thickness varies.

12. The method of claim 11, in which said analysis is used to provide an optimised endpoint approach using the illumination source illuminating an area of an article being processed.

13. The method of claim 1, including the further step of tuning the illumination means to a selected wavelength.

14. The method of claim 13, in which said selected wavelength is chosen in dependence on the material being examined and remains constant throughout the process.

15. The method of claim 13, in which said selected wavelength is tuned to a number of different wavelengths during the process, and the detected signals are compared with a family of predictions.

16. The method of claim 15 in which the family of predictions includes predictions for feature width as well as depth, and in which the results derived from tuning to different wavelengths are compared with the best fit of a family of predictions to give an estimate of the width of the etch feature.

17. The method of claim 1, in which the spectrally narrow illumination source is provided by combining a spectrally broad source with a wavelength discriminating means.

18. The method of claim 1, in which the illumination source comprises light generated by the deposition or etch process itself.

19. The method of claim 18, in which the deposition or etch process is a plasma process.

20. Apparatus for use in a semiconductor manufacturing process, the apparatus comprising:

a vacuum enclosure;

a workpiece location within the enclosure for locating a semiconductor workpiece to be processed to produce a structure having a small feature size, said semiconductor workpiece having an ordered feature arrangement having a feature size of the same order as the structure to be produced and being arranged in a regular pattern having a given feature spacing;

an illumination source producing light at one or more wavelengths each within 30% of a whole number of wavelengths of a size equal to the projection upon a plane normal to the incident illumination of said feature spacing;

optical projection means cooperating with the light source to produce an optical probe measurement beam directed to said workpiece location;

optical detection means arranged to detect an oscillation of a polarisation component in the light beam reflected from the article being processed which is derived substantially from anomalous reflection or Rayleigh Resonance at the feature arrangement resulting from the illumination; and

data processing means arranged to use the oscillation to detect or predict the desired endpoint or monitor the progress in real time of the etch or deposition.

21. Apparatus according to claim 20, in which the illumination source or the detection means or both is provided with polarisation means.

22. Apparatus according to claim 21, in which said polarisation means is fixed.

23. Apparatus according to claim 21, in which said polarisation means is rotating.

24. Apparatus according to claim 20, in which the illumination means is tunable.

25. Apparatus according to claim 24, in which the illumination source is tuned to a plurality of wavelengths during production of a given product, and the data processing means is arranged to compare the detected signals with a family of predictions at said plurality of wavelengths.